

Diamond Valley Water Resource Management

March 19, 2009
Eureka, Nevada

Introductions

- Jason King, Acting State Engineer
- Kelvin Hickenbottom, Deputy State Engineer
- Rick Felling, Chief of Hydrology
- Tom Gallagher, Chief of Water Rights
- Tim Wilson, Hearings Officer
- Kirk Owsley, Supervising Water Commissioner (Elko Office)
- Rich Perry, Basin Inventory Engineer (Elko Office)



Why Are We Here?

- The basin is severely over-appropriated
 - 133,000 AF committed
 - 75,000 AF pumped
 - 30,000 AF perennial yield
- Initiate discussions on how to best manage the water resources in Diamond Valley.
- Let you know what tools are available.
- Incorporate suggestions from the water users in Diamond Valley.
- Explore all options that will reduce or delay the adverse effects of ground-water pumping in the basin.



We Are Not Here To:

- **WE ARE NOT** here to say that beginning tomorrow we will begin cutting off rights by priority.
- **WE ARE NOT** here to say that we are beginning an adjudication of the basin.
- **WE ARE NOT** here to place blame for mistakes made in the past.
- **WE ARE NOT** here as a result of activities in Kobeh Valley.



Agenda

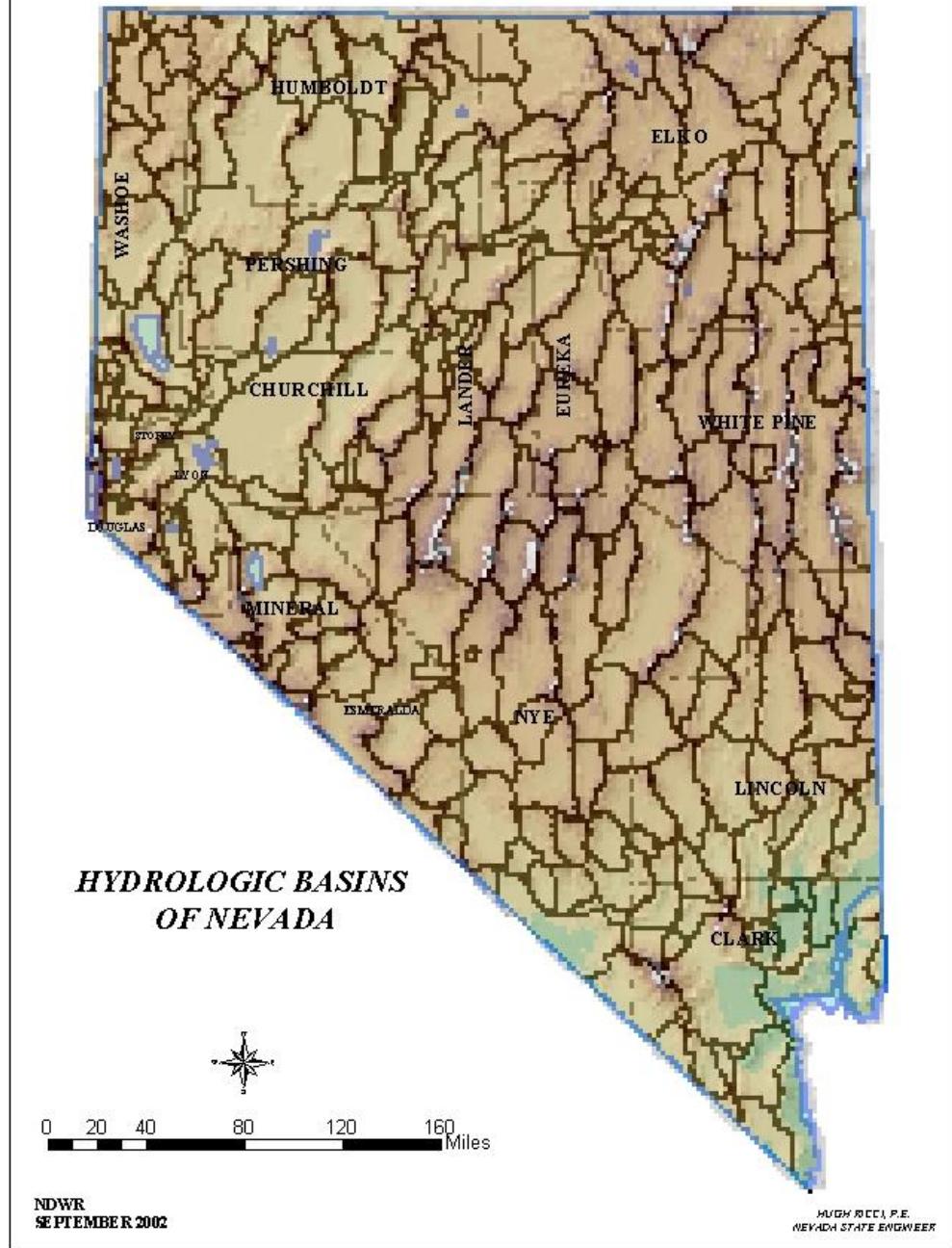
1. Administering Ground Water in Nevada
2. Hydrology Overview
3. Perennial Yield of Diamond Valley
4. Existing Ground-water Rights in Diamond Valley
5. How did the Basin get Over Appropriated?
6. Pumpage Inventory
7. Water Table Drawdown
8. Review of Previous Stakeholder Meetings
9. Decisions and Orders of the State Engineer in Diamond Valley
10. Management of the Basin - Options
11. Open Discussion on Future Management of Diamond Valley



Ground Water

State divided into
256 hydrographic
basins and sub-
basins.

Each basin is
administered
separately.



Ground Water

- **Ground-Water Basins are Managed Based on the Perennial Yield Concept**
 - The maximum amount of ground water that can be used each year over the long term without depleting the ground-water reservoir.
 - **The goal is to appropriate water up to the perennial yield of a basin.**
 - We exceeded that goal in Diamond Valley!



Perennial Yield

Origin of Estimates of Perennial Yield

- 1960 Legislature authorized surveys by the USGS to establish perennial yields for all basins statewide (some work had been done since 1945)
 - Very good estimates of water availability
- As technology advances, estimates of PY are updated.

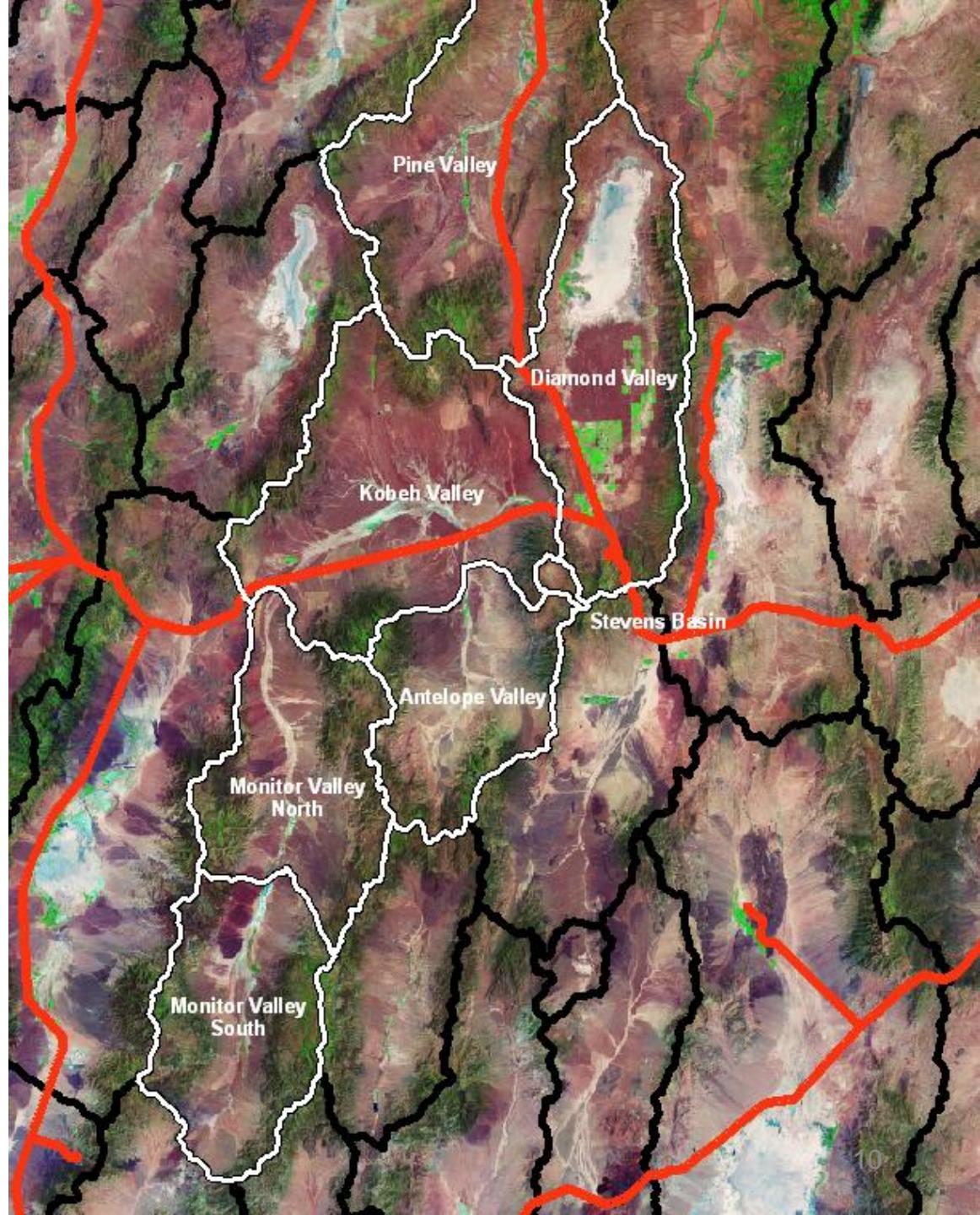


Designated vs. Non-Designated Ground-Water Basins

- Designating a basin enables the State Engineer to impose additional conditions and restrictions on water use.
- A designated basin is not necessarily closed to additional appropriations. Preferred uses of water may be allowed; e.g., commercial, industrial, typically for minimal amounts.



Diamond Valley Flow System

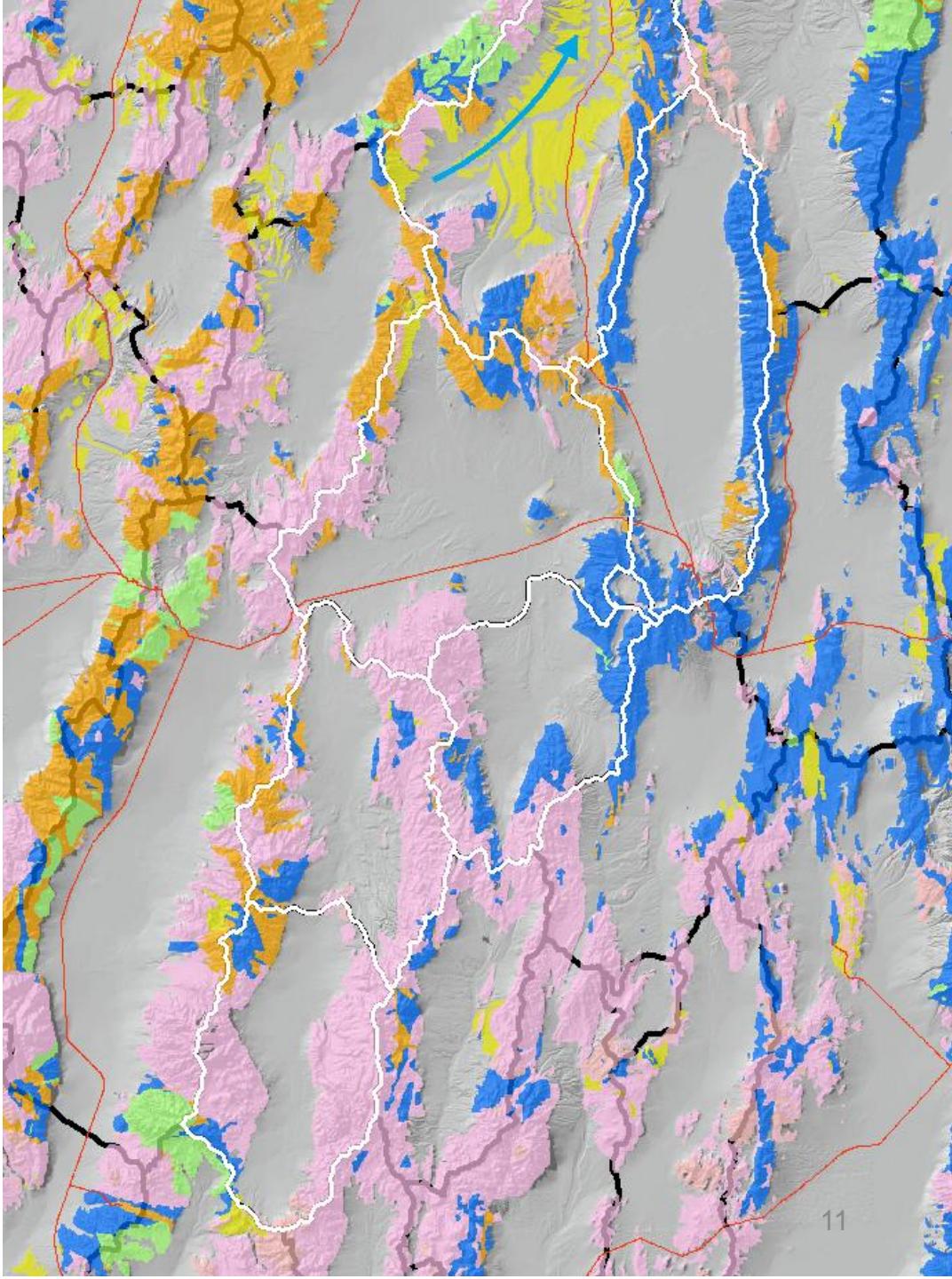


Diamond Valley Flow System

General Hydrogeology

- Valley Fill
- Volcanics
- Granitic
- Carbonates
- Clastics

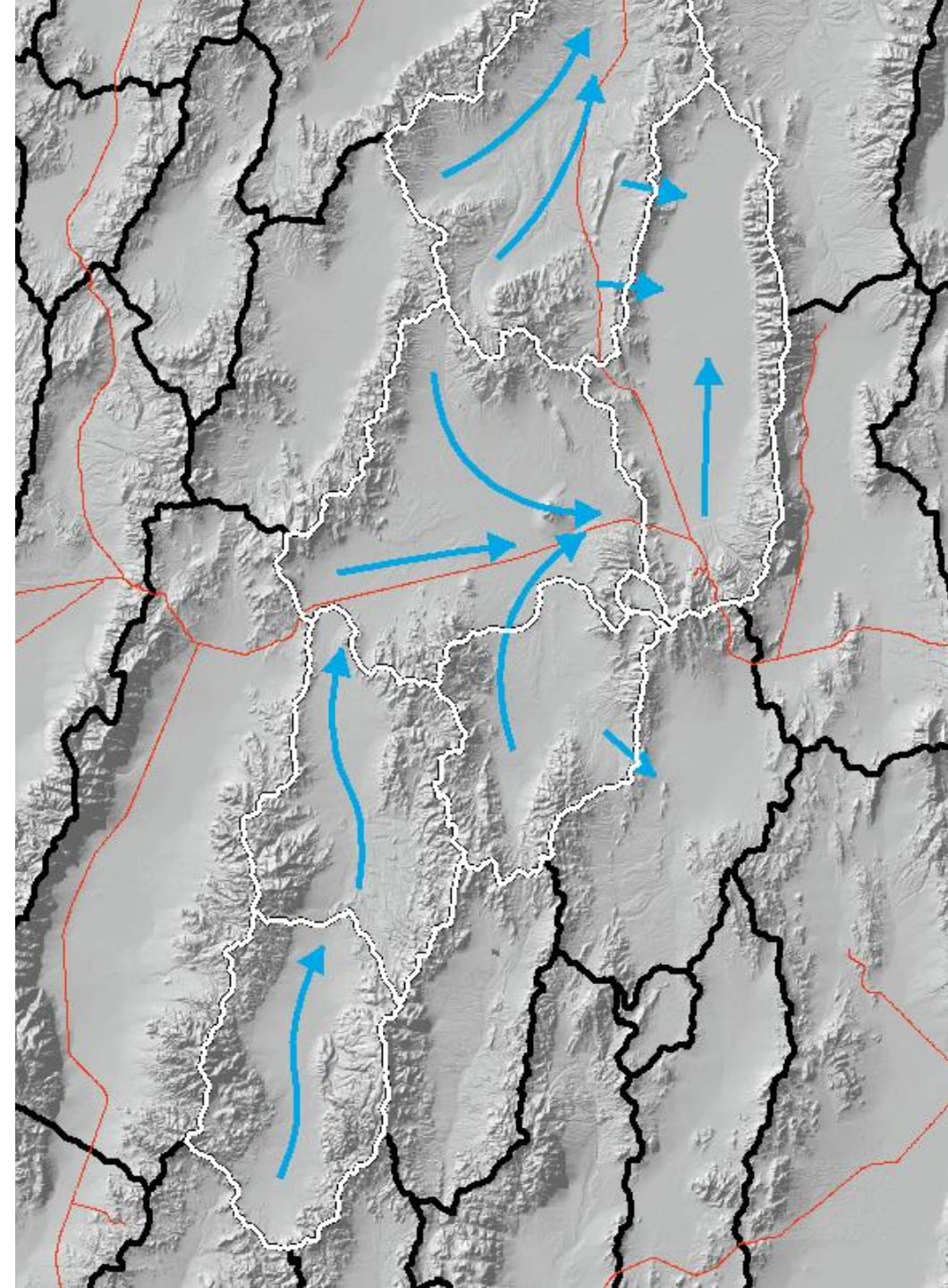
3/19/2009



11

Diamond Valley Flow System

Ground-Water Flow Paths



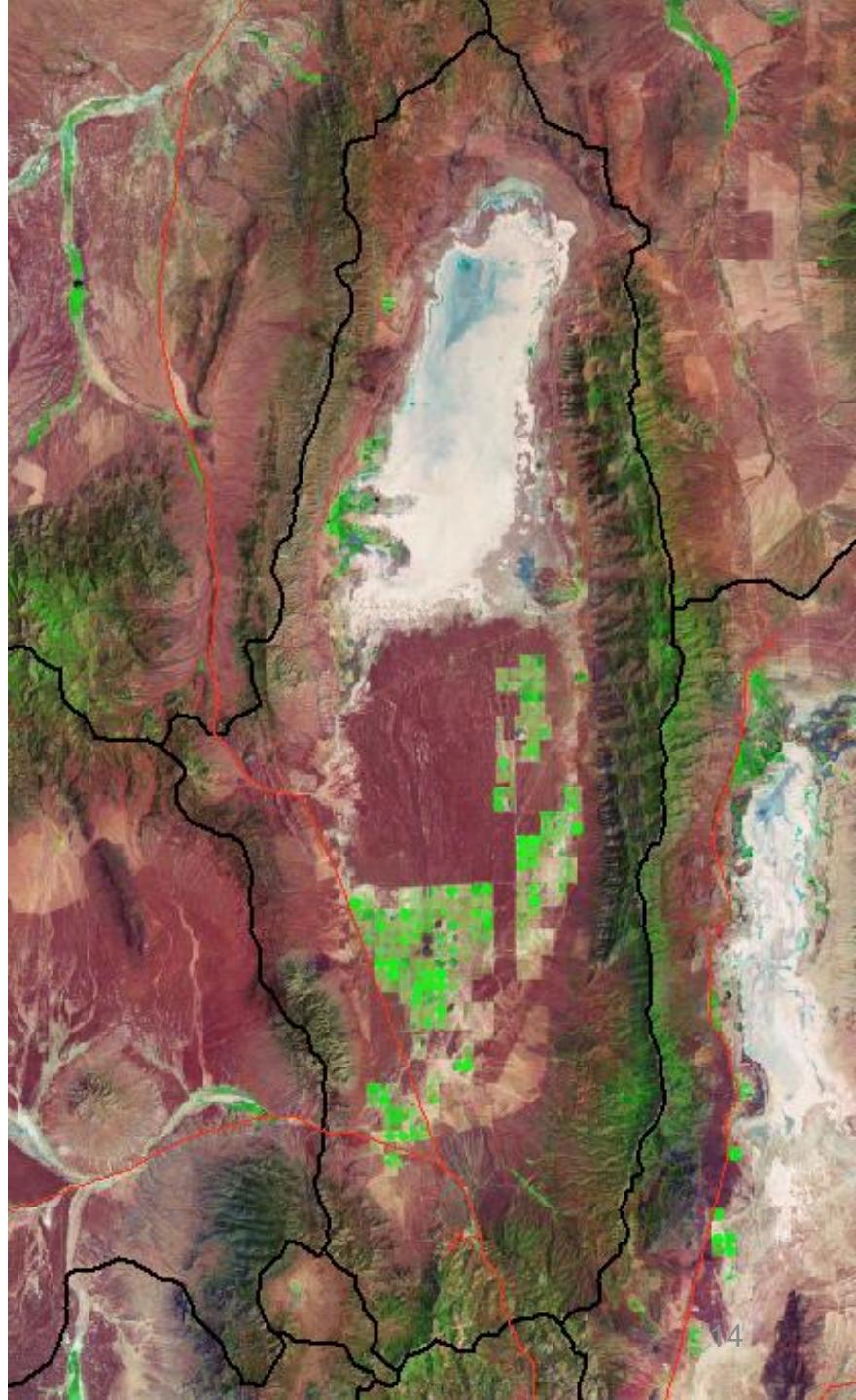
Diamond Valley Water Budget Studies

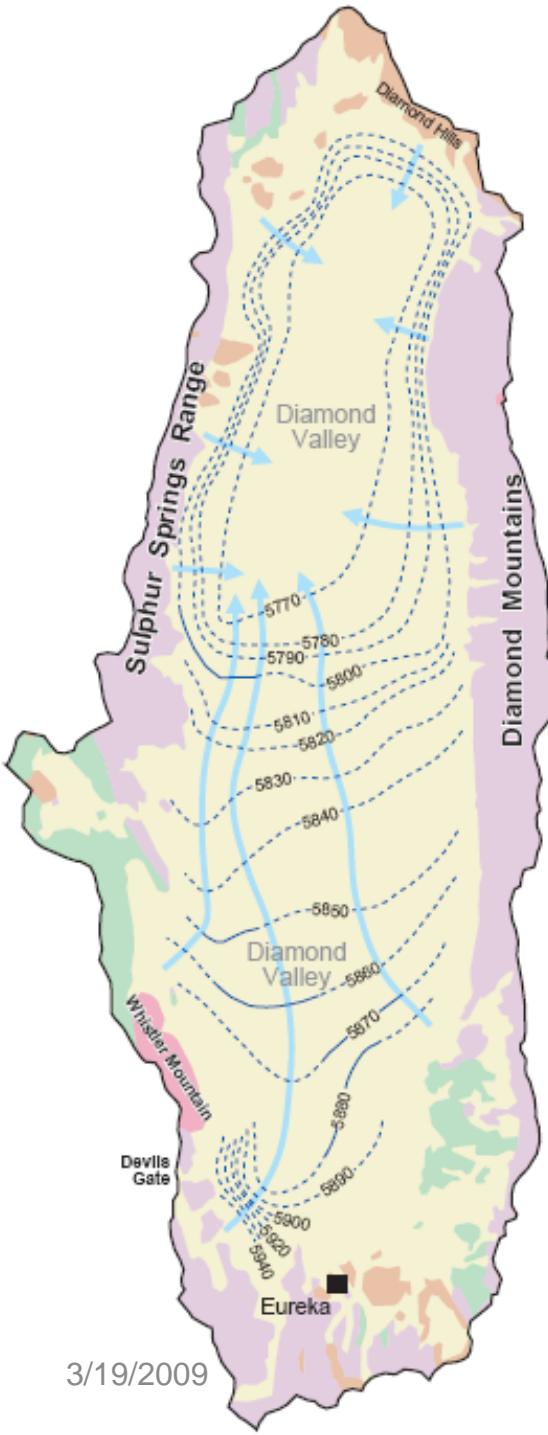
	<u>Eakin, 1962</u>	<u>Harrill, 1968</u>
Recharge:	16,000 AF	21,000 AF
ET:	23,000 AF	30,000 AF
Perennial Yield:	23,000 AF	30,000 AF



Diamond Valley

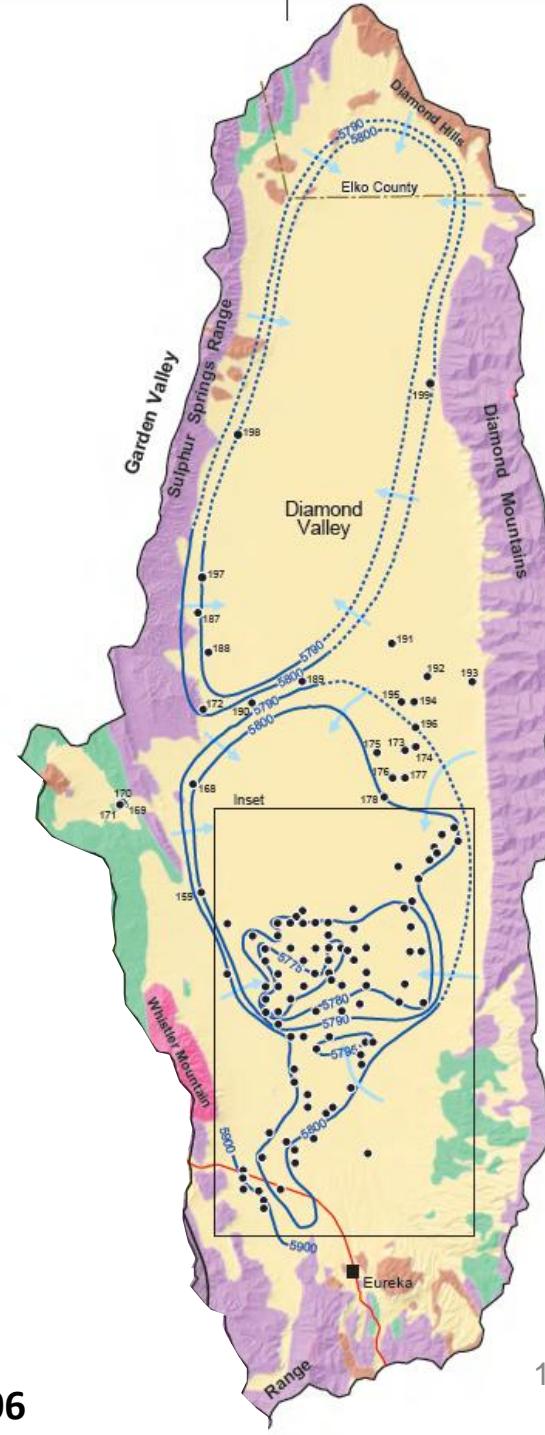
Basin Overview





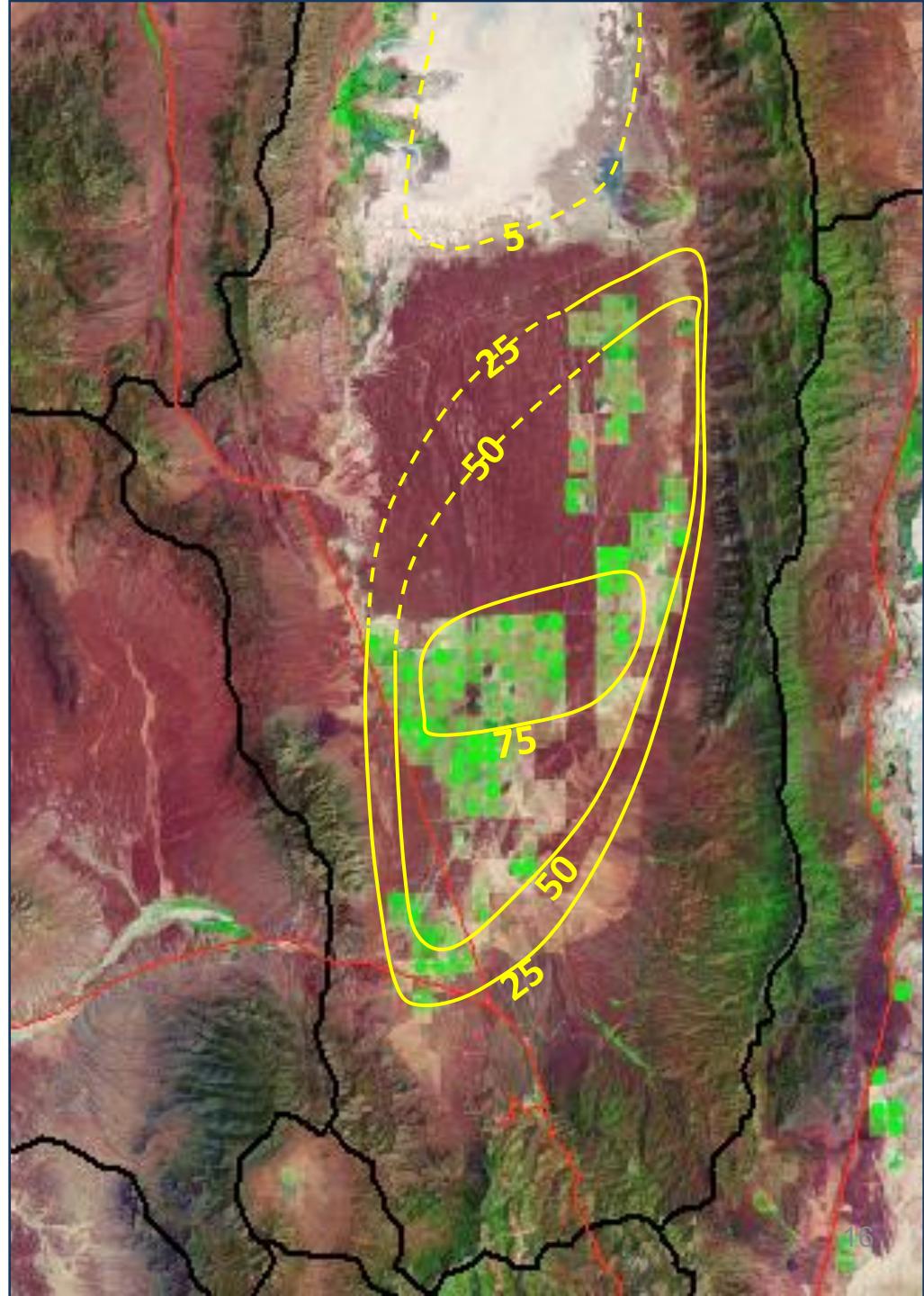
EXPLANATION

- Basin-fill deposits (Quaternary and Tertiary)—Unsorted to poorly sorted clay, silt, sand, gravel and boulders of alluvial fans; and alternating beds of fine-grained deposits (clay or silt) and coarse-grained deposits (sand or gravel) of basin lowlands
- Volcanic rocks (Tertiary)—Lava flows and shallow intrusives of rhyolitic, dacitic, andesitic, and basaltic composition overlain by ash-flow and air-fall tuffs
- Igneous intrusive rocks (Tertiary to Jurassic)—Granitic rocks and mafic dikes associated with the northern Nevada rift. Dikes have intruded siliciclastic sedimentary rocks and carbonate rocks and are exposed in Roberts Mountains and are believed to have intruded carbonate rocks of northern Fish Creek Range at shallow depths (Zoback and others, 1994, p. 375)
- Siliciclastic sedimentary rocks (Devonian to Cambrian, Mississippian, Permian, and Cretaceous)—Shale, siltstone, sandstone, conglomerate, chert, and subordinate limestone
- Carbonate rocks (Devonian to Cambrian and Pennsylvanian)—Limestone, dolomite and subordinate shale and sandstone
- Water-level contour—Shows altitude of shallow ground-water surface. Dashed where uncertain. Contour interval, in feet. Datum is sea level
- ← Direction of ground-water flow inferred from water-level contours



Diamond Valley

Ground-Water
Level Decline Due
to Agricultural
Pumping



Diamond Valley

Hydrographic Area Summary

• Hydrographic Area Number	10-153
• Designated	Yes
• State Engineer Orders	
• 277 – Designation	August 5, 1964
• 280 – Amended Designation	August 28, 1964
• 541 – Notification of Curtailment	December 22, 1975
• 717 - Notification of Curtailment	July 10, 1978
• 815 – Amended Designation	April 4, 1983
• Committed Ground-water Resources	133,248 Acre-Feet
• Perennial Yield	30,000 Acre-Feet
• Reference	USGS Bulletin 35
• Consumptive Use (Alfalfa)	2.3 Acre-feet



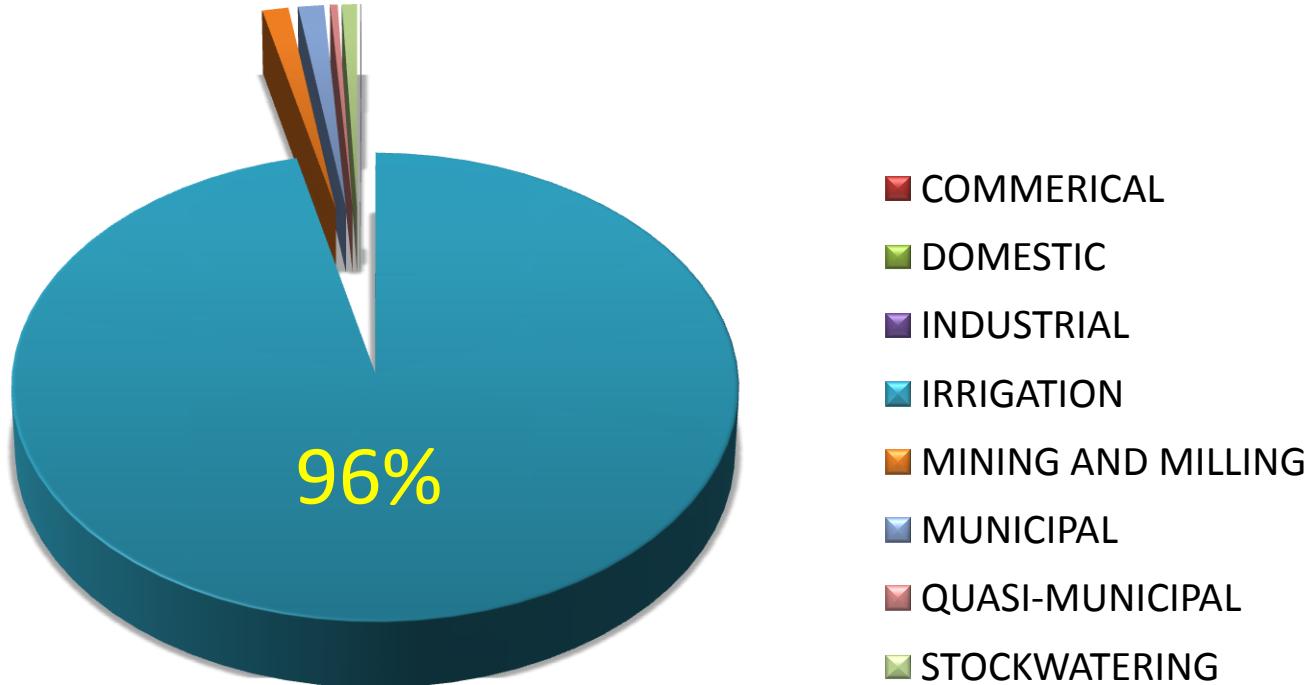
Ground-water Development

Manner Of Use

<u>MANNER USE</u>	<u>ACRE-FEET</u>
Commercial	3
Domestic	34
Industrial	40
Irrigation	128,320
Mining and Milling	1,707
Municipal	1,679
Quasi-Municipal	483
<u>Stockwatering</u>	<u>987</u>
TOTAL	133,248 AF

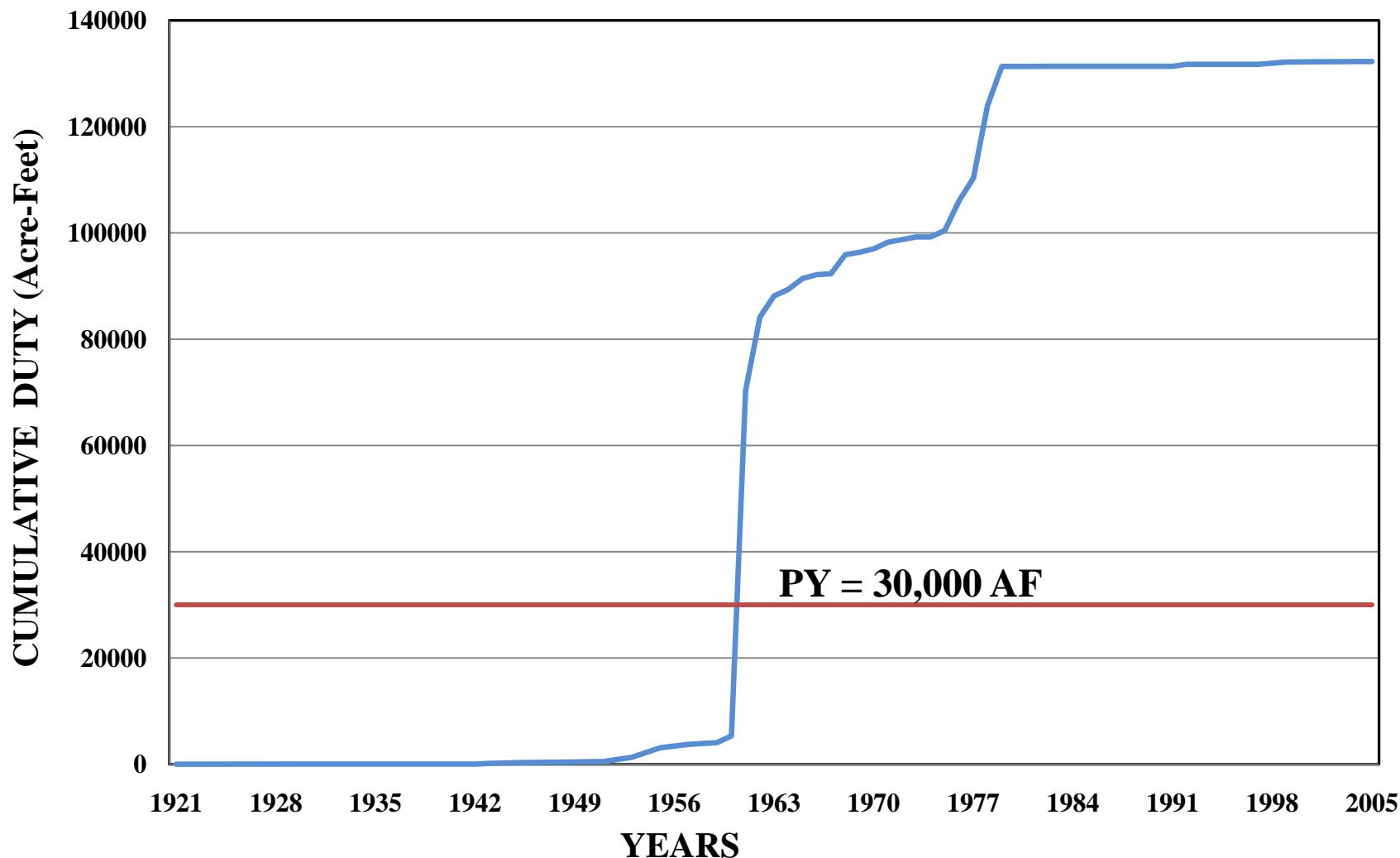


DIAMOND VALLEY BASIN SUMMARY BY MANNER OF USE



WATER RIGHTS IN DIAMOND VALLEY

1921 - 2005



GROUND-WATER DEVELOPMENT

- First Ground-water Irrigation Water Right Approved 1951
- First Estimates of Irrigated Acreage
 - 1957 500 acres (1,180 ac-ft)
 - 1958 370 acres (1,854 ac-ft)
- Major Ground-water Development in 1960's
 - 1965 19,300 ac-ft
 - 1966 22,400 ac-ft
 - 1967 19,360 ac-ft
 - 1968 18,160 ac-ft
 - 1969 22,900 ac-ft
- Electricity Comes to Diamond Valley
 - 1975 to 1981 ~ 70,000 ac-ft/year



Diamond Valley Ground-Water Basin

- Estimated perennial yield = 30,000 acre-feet
- Total committed water rights around 133,000 acre-feet
- Review water-level declines in the south half of the valley in response to development
- How much is pumped each year?
- Where do we get the pumpage values?



Diamond Valley

Hydrograph For Site 153 N21 E63 09BBDD1



Hydrograph For Site 153 N22 E54 08CDCD1



Hydrograph For Site 153 N21 E63 22BDBB1



Hydrograph For Site 153 N21 E63 03CDBB1



Estimated Irrigated Acreage and Estimated Ground-Water Pumpage, Diamond Valley, Nevada, 1950-2008

- Review the historical inventories of irrigated acreage
- Early estimate of the duty of water applied
- Overall capacity of the wells in the valley
- Growing season
- Estimating pumpage
- Total ground-water pumpage



Estimated Irrigated Acreage

Diamond Valley, Nevada, 1950-2008

- Early historical inventories of irrigated acreage were made by the State Engineer's Office and USGS.
- Between 1950 and 1960 the total ground water pumped was less than 3,000 acre-feet annually.
- First crop inventory published in 1965 with 7,600 acres irrigated, 16,000 acre-feet used for a duty of about 2.1 acre-feet per acre.



Estimated Duty

Diamond Valley, Nevada, 1950-2008

- This duty gradually increased in the State Engineer's inventories to about 2.5 acre-feet per acre through 1974.
- After 1975 all crop inventories use about 3 acre-feet per acre.
- So, how did we generate these duty values?



Estimated Duty

Diamond Valley, Nevada, 1950-2008

- Based on the climate data available in 1975, the State Engineer estimated the consumptive use of water for alfalfa at 1.9 acre-feet per acre.
- Then we applied an irrigation efficiency of between 65 and 75 percent for a gross pumpage estimate of 2.5 to 3.0 acre-feet per acre.
- What other ways can we estimate pumpage?



Well Capacity in Diamond Valley

- USGS published results of 285 well tests, 71% of which were within T21N, R53E & R54E.
- Median value of wells tested was about 905 gallons per minute (gpm), (Arteaga et al., Figure 4, p. 9, 1995).
- $905 \text{ gpm} / 448.83 \text{ gpm/cfs} = 2.0 \text{ cubic feet per second.}$
- $2.0 \text{ cfs} * 1.98 \text{ acre-feet per day per cfs} = 4.00 \text{ AF per day per well.}$
- Estimating the number of days of round-the-clock operation gives total acre-feet pumped each season per well.

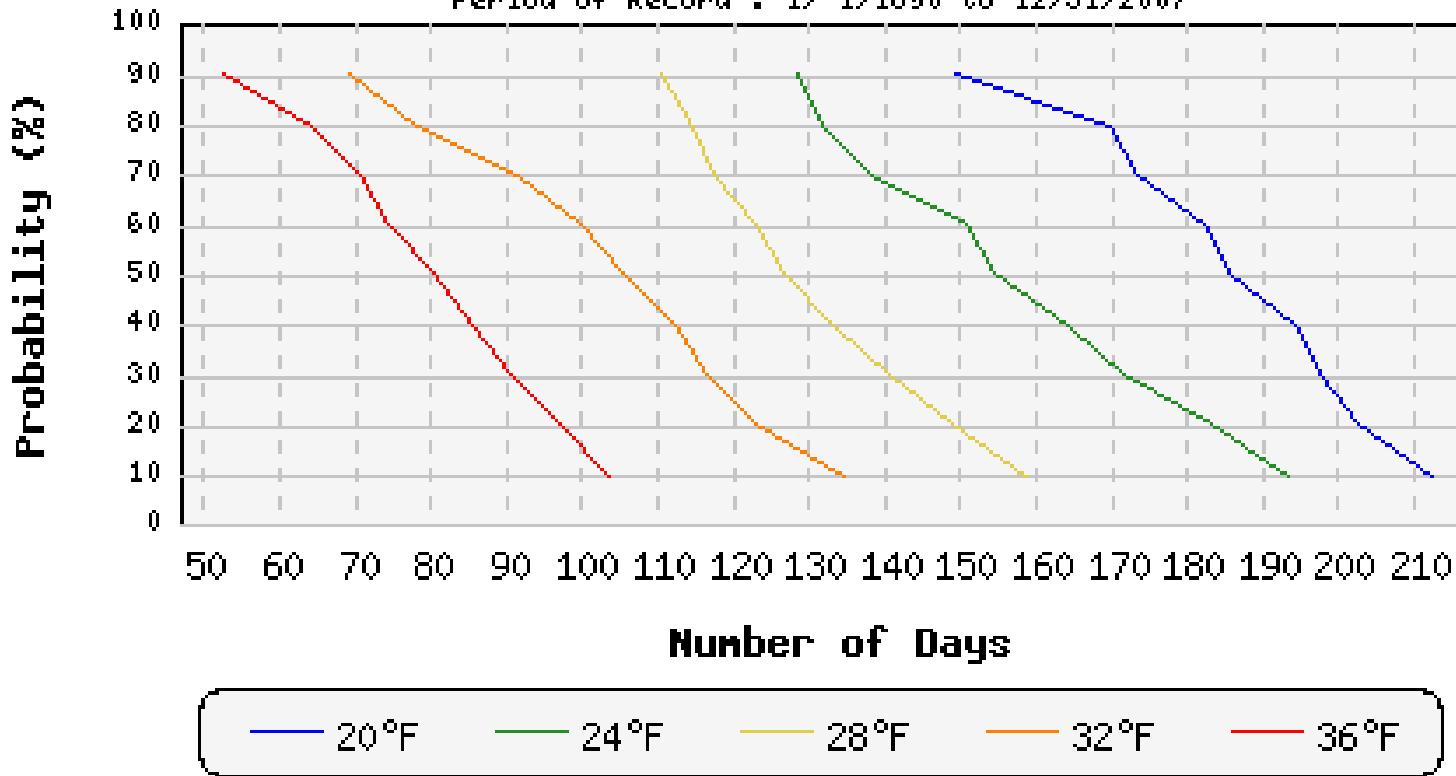


Estimated Growing Season

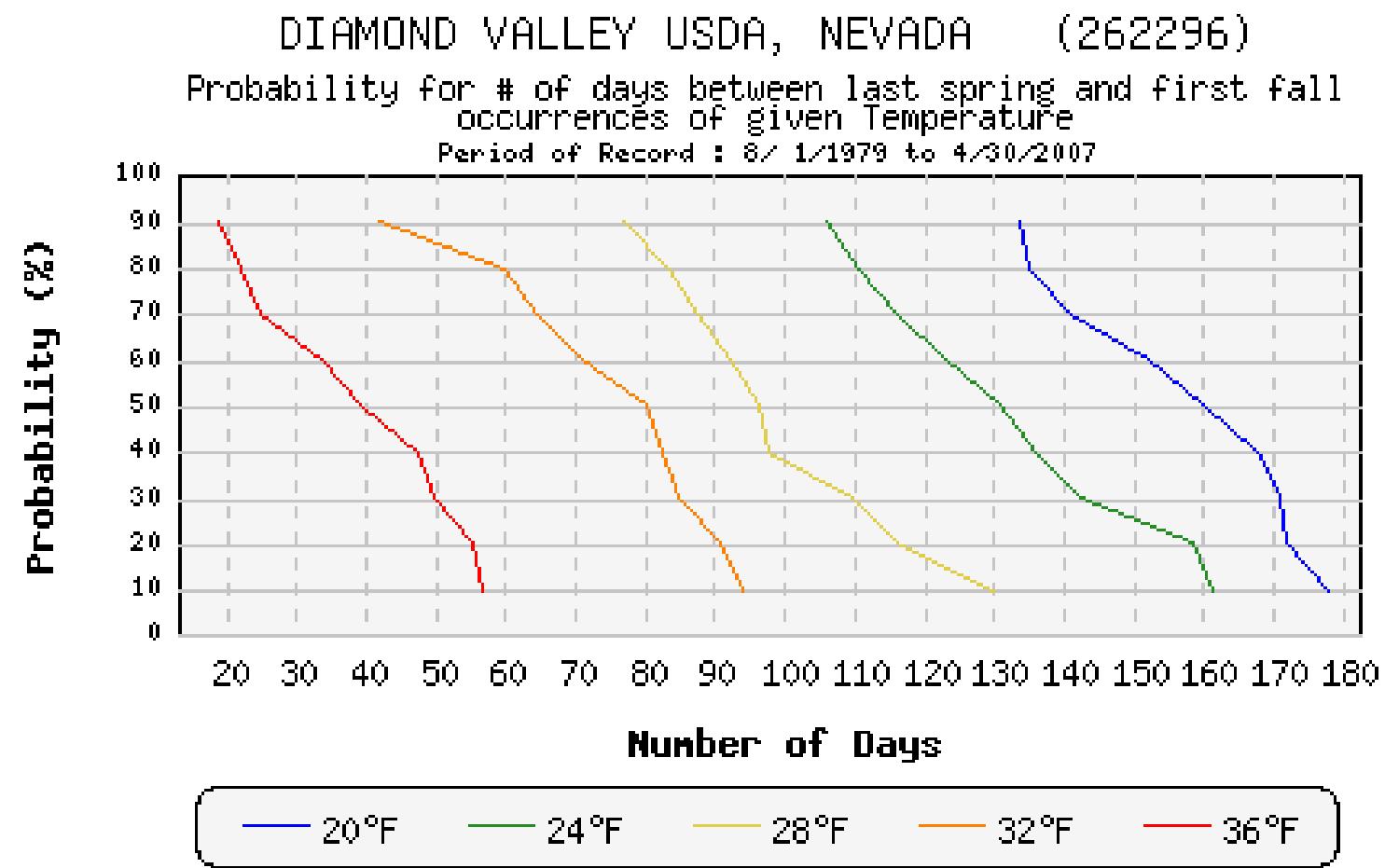
EUREKA, NEVADA (262708)

Probability for # of days between last spring and first fall occurrences of given Temperature

Period of Record : 1/ 1/1890 to 12/31/2007



Estimated Growing Season



Length of 'Freeze Free' Season Probabilities

DIAMOND VALLEY USDA, NEVADA (262296)													
Temp F	Shortest	90%	80%	70%	60%	50%	40%	30%	20%	10%	Longest		
36.5	1	18	21	24	33	38	47	49	54	56	59		
32.5	35	41	59	64	70	79	82	84	90	93	95		
28.5	74	76	83	86	91	96	97	109	115	129	136		
24.5	96	105	110	115	122	130	135	141	158	160	164		
20.5	113	133	134	140	151	159	167	170	171	177	188		

Graphic Output

Shortest - Least number of consecutive days recorded with minimum temperature above threshold.

*** means minimum temperature below threshold has not occurred.

xx% - Percent probability that a consecutive number of days will occur with the minimum temperature not below the threshold.
*** means non-occurrence of the threshold

Longest - Greatest number of consecutive days recorded with minimum temperature above threshold.
*** means that at least one year occurred when minimum temperature below threshold was not recorded.

Note: All periods include August 1.

Western Regional Climate Center, wrcc@dri.edu



Estimating Pumpage in Diamond Valley

- So, if we choose the 50 percentile value between 24 and 28 degrees as our frost free growing season of 115 days, and we assume about 21 days when pumps are off for cutting and bailing hay, gives an average of 94 days of round the clock pumpage.
- 94 days at 4.0 acre-feet per day = 376 acre-feet per well.
- 376 acre-feet per 125 acre pivot = 3.01 acre-feet per acre.

...OR...

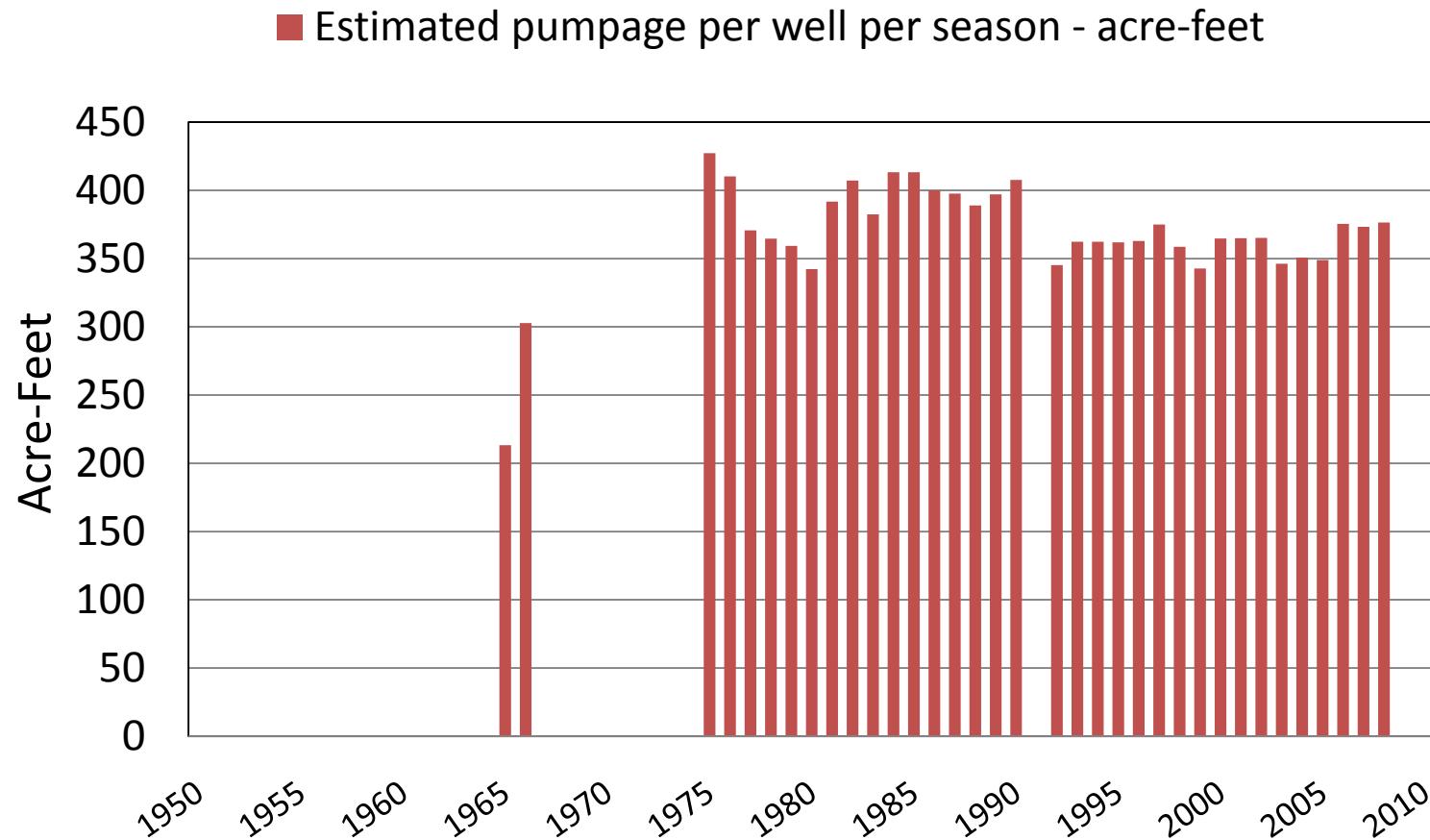


Estimating Pumpage in Diamond Valley

- Using the number of active wells recorded for the inventoried years 1975-1994
- Dividing the total pumpage each year by the number of active wells yields an average of about 386 acre-feet per well
- $386 \text{ acre-feet per well} / 125 \text{ acre pivots} = 3.1 \text{ acre-feet per acre}$



Diamond Valley, Nevada



Estimating Pumpage in Diamond Valley

- The pumpage estimate reported by the USGS (Arteaga, et al., 1995, p.5) for the year 1990, confirming Landsat imagery with field checking, was 64,400 acre-feet on 22,200 acres for an overall duty of 2.90 acre-feet per acre.



Average Pumpage in Diamond Valley

- Inventoried acreage in 2008 was 24,220 acres, 193 active wells
- $24,220 \text{ acres} / 125 \text{ acres per pivot} = 193.76 \text{ equivalent pivots}$
- 193 wells at 4.0 acre-feet per day = 772 acre-feet per day
- 772 acre-feet per day * 94 pumping days = 72,568 acre-feet per season

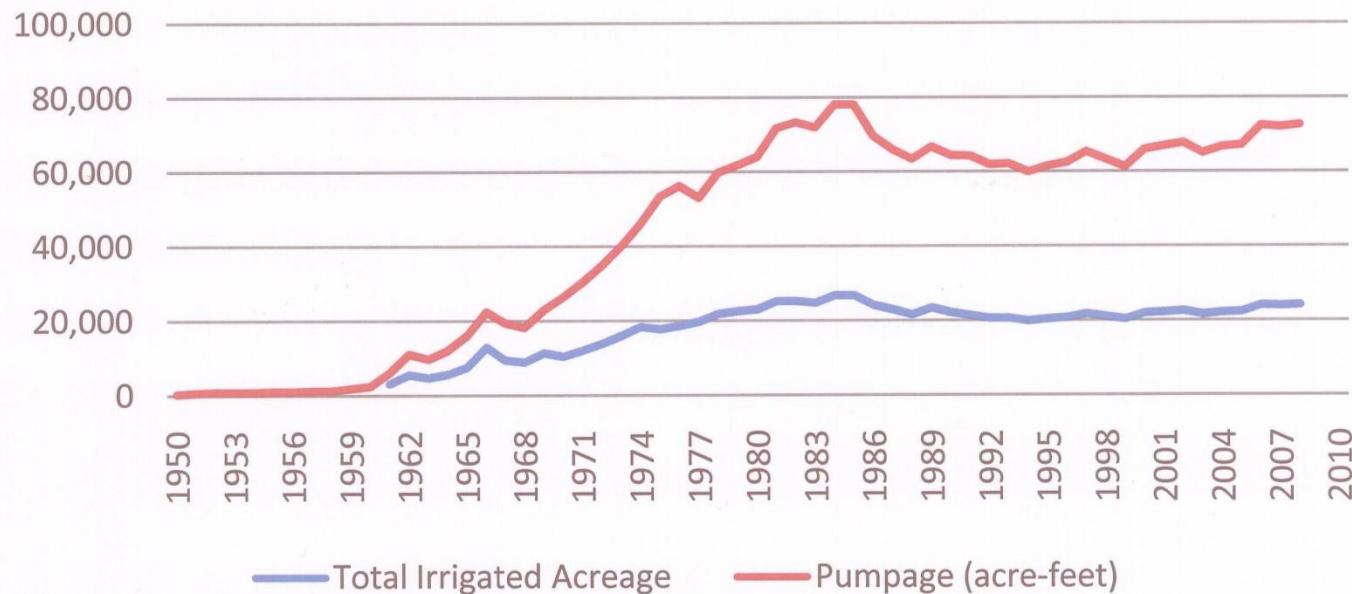


Average Pumpage in Diamond Valley

- $72,568 \text{ acre-feet} / 24,220 \text{ acres} = 3.00 \text{ acre-feet per acre}$
- Even if we use 772 acre-feet per day * 100 pumping days maximum = 77,200 acre-feet per season
- $77,200 \text{ acre-feet} / 24,220 \text{ acres} = 3.19 \text{ acre-feet per acre}$



Estimated Irrigated Acreage and Estimated Pumpage in Diamond Valley, Nevada, 1950-2008



Data for 1950-65 from Harrill 1968; Data for 1966-89 and 1991-2008 from files of NDWR; data for 1990 based on field inventories by U.S. Geological Survey, Arteaga et al, 1995

Historical Perspective: Orders of the State Engineer in Diamond Valley

- 277 – Designation August 5, 1964
- 280 – Amended Designation August 28, 1964
 - Removed Town of Eureka
- 541 – Curtailment December 22, 1975
 - Irrigation Denied unless Previously Forfeited
- 717 - Curtailment July 10, 1978
 - All Irrigation Denied after December 31, 1978



Orders of the State Engineer in Diamond Valley

- 809 Totalizing Meter December 1, 1982
 - 813 Amending Order 809 February 7, 1983
 - Totalizing Meter or Authorized Measuring Device
 - 815 – Amended Designation April 4, 1983
 - Entire Basin – No Exceptions



Previous Meetings in Diamond Valley

- 1982 Curtailment Hearing – Concern was that the valley's irrigators were going to reach a point where economic survival was going to be a factor because pumping would not be economical and decreased spring flow was a problem that was not going to go away.



Formation of Diamond Valley Ground-Water Board (NRS 534.035)

February 6, 1992

- State Engineer Mike Turnipseed offered the following suggestions to control ground-water pumping.
 1. Forfeit those water rights that have not been used in a long time;
 2. Everyone should take a cut across the board. This could be accomplished by Order of the State;
 3. The State Engineer could reduce duties to an appropriate level; or
 4. Water rights could be cut by priority as set forth in NRS 534.
- * Mr. Turnipseed's recollection is that the formation of the board failed due to funding issues.



State Engineer Options

- Regulate by Priority
- Forfeit water rights
- Change irrigation rights for consumptive use only
- Cancel water rights for failure to show due diligence
- Deny all extension of time requests and call for PBU's
- Impose fines and penalties for over pumping,
pumping outside the permitted place of use or any
other violation of the water law, permits, certificates,
statutes or regulations



GROUND-WATER RIGHTS BY PRIORITY

App_Status	Duty_balance	Units	Cumulative total		Priority_date		
			duties	Use			
V03033 VST		0.00NULL		0.00STK			
6369 CER		6.23 AFS		6.23 STK	1/6/1921		
6584 CER		12.03 AFS		18.26 STK	11/7/1921		
V02959 VST				18.26 STK	1/1/1929		
10824 CER		67.21 AFA		85.47 STK	5/8/1942		
10827 CER		67.30 AFA		152.77 STK	5/19/1942		
11004 CER		68.33 AFA		221.10 STK	9/23/1943		
11008 CER		67.21 AFA		288.31 STK	9/23/1943		
11359 CER		144.79 AFA		433.10 MM	8/17/1945		
13198 CER		25.41 AFA		458.51 STK	12/19/1949		
13200 CER		25.41 AFA		483.92 STK	12/19/1949		
13580 CER		25.35 AFA		509.27 STK	12/26/1950		
30927 CER		69.12 AFA		578.39 IRR	17.28	17.28	3/2/1951
44606 CER		12.64 AFA		591.03 IRR	3.16	20.44	3/2/1951
44609 CER		158.44 AFA		749.47 IRR	39.61	60.05	3/2/1951
13726 CER		6.51 AFA		755.97 STK		60.05	5/18/1951
13727 CER		8.68 AFA		764.66 STK		60.05	5/18/1951
48871 CER		525.60 AFA		1290.26 IRR	131.4	191.45	9/17/1951
70588 PER		0.00 AFA		1290.26 IRR		191.45	9/17/1951
44451 CER		576.58 AFA		1866.84 IRR	144.15	335.60	3/30/1953
53872 CER		617.20 AFA		2484.04 IRR		335.60	3/30/1953
14948 CER		617.20 AFA		3101.24 IRR	308.6	644.20	3/30/1953
71748 PER		630.24 AFA		3731.48 IRR	157.56	801.76	5/9/1955
17226 CER		52.40 AFA		3783.88 IRR	13.1	814.86	3/29/1957
22450 CER		267.60 AFA		4051.48 IRR	66.9	881.76	3/29/1957
18242 CER		1280.00 AFA		5331.48 IRR	320	1201.76	8/13/1959
72370 PER		AFA		5331.48 IRR		1201.76	8/13/1959
18621 CER		825.16 AFA		6156.64 IRR	206.29	1408.05	3/7/1960
18622 CER		AFA		6156.64 IRR		1408.05	3/7/1960
18623 CER		1112.88 AFA		7269.52 IRR	278.23	1686.27	3/7/1960
22551 CER		AFA		7269.52 IRR		1686.27	3/7/1960



GROUND WATER RIGHTS BY PRIORITY

App_Status	Duty_balance_Units	Cumulative total					Priority_date
		duties	Use	Acres	Cumulative Acres		
22194CER	537.04 AFA	7806.56IRR		134	1820.27		3/7/1960
22195CER	622.00 AFA	8428.56IRR		155.5	1975.77		3/7/1960
22648CER	1186.88 AFA	9615.44IRR		296.72	2272.49		3/7/1960
22921CER	AFS	9615.44IRR			2272.49		3/7/1960
22922CER	646.36 AFS	10261.80IRR		161.59	2434.08		3/7/1960
27976CER	504.48 AFA	10766.28IRR		126.12	2560.20		3/7/1960
55727CER	20.56 AFA	10786.84IRR		5.139	2565.34		3/7/1960
64630CER	288.67 AFA	11075.51IRR		72.71	2638.05		3/7/1960
64631CER	AFA	11075.51IRR			2638.05		3/7/1960
64632CER	AFA	11075.51IRR			2638.05		3/7/1960
36321CER	AFS	11075.51IRR			2638.05		3/7/1960
36322CER	AFS	11075.51IRR			2638.05		3/7/1960
42891CER	141.77 AFA	11217.28IRR		35.44	2673.49		3/7/1960
22982CER	1260.80 AFA	12478.08IRR		315.2	2988.69		3/9/1960
24609CER	1108.14 AFA	13586.22IRD		280.8	3269.49		3/14/1960
22352CER	129.28 AFA	13715.50IRR		32.32	3301.81		3/21/1960
70940CER	502.72 AFA	14218.22IRR		125.68	3427.49		3/21/1960
22353CER	632.00 AFS	14850.22IRR		158	3585.49		3/21/1960
23803CER	684.80 AFA	15535.02IRR		171.2	3756.69		4/11/1960
18714CER	836.00 AFA	16371.02IRD		209	3965.69		4/11/1960
24574CER	680.68 AFA	17051.70IRD		170.17	4135.86		4/22/1960
23271CER	1270.80 AFA	18322.50IRR		317.7	4453.56		4/22/1960
23272CER	640.00 AFA	18962.50IRR		160	4613.56		4/22/1960
22566CER	468.00 AFA	19430.50IRR		117	4730.56		4/22/1960
22567CER	468.00 AFA	19898.50IRR			4730.56		4/22/1960
28641CER	640.00 AFA	20538.50IRR		160	4890.56		4/22/1960
29405CER	591.32 AFS	21129.82IRR		147.83	5038.39		4/22/1960
57838CER	172.00 AFA	21301.82IRR		43	5081.39		4/22/1960
50963CER	172.00 AFA	21473.82IRR		43	5124.39		4/22/1960
77328T	PER	21473.82IND			5124.39		4/22/1960
18786CER	1280.00 AFA	22753.82IRD		320	5444.39		5/2/1960
18787CER	AFS	22753.82IRD			5444.39		5/2/1960



GROUND WATER RIGHTS BY PRIORITY

App_Status	Duty_balance	Units	Cumulative total			Priority_date
			duties	Use	Acres	
18788CER	1280.00	AFA	24033.82	IRD		5/2/1960
18789CER		AFA	24033.82	IRD		5/2/1960
18794CER	480.00	AFA	24513.82	IRD	120	5/2/1960
18796CER	640.00	AFA	25153.82	IRD	160	5/2/1960
18797CER	640.00	AFA	25793.82	IRR	160	5/2/1960
48948CER	478.56	AFA	26272.38	IRR	119.64	5/3/1960
28036CER	277.00	AFA	26549.38	IRR	69.25	5/3/1960
18802CER	640.00	AFA	27189.38	IRR	160	5/4/1960
18834CER	1276.23	AFA	28465.61	IRR	319.06	5/12/1960
18835CER	1277.80	AFA	29743.41	IRR	319.45	5/12/1960
18851CER	516.44 AFA		30259.85	IRD	129.11	7000.90
23808CER	544.00	AFA	30803.85	IRR	136	5/16/1960
70587PER		AFA	30803.85	IRR		5/16/1960
24127CER	1280.00	AFA	32083.85	IRR	320	5/18/1960
24128CER		AFA	32083.85	IRR		5/18/1960
24129CER	1240.80	AFA	33324.65	IRR	310.2	5/18/1960
24130CER		AFA	33324.65	IRR		5/18/1960
24264CER	928.92	AFA	34253.57	IRR	232.23	6/3/1960
24265CER	944.00	AFA	35197.57	IRR	236	6/3/1960
57839PER	164.00	AFA	35361.57	IRR	41	6/3/1960
57840PER	148.92	AFA	35510.49	IRR	37.23	6/3/1960
66062PER	303.08	AFA	35813.57	IRR	75.77	6/3/1960
73431PER	346.61	AFA	36160.18	MM		6/6/1960
75105PER	39.20	AFA	36199.38	MM		6/6/1960
42019CER		AFA	36199.38	IRR		6/6/1960
18908CER	447.57	AFS	36646.95	IRR	111.89	6/6/1960
18978CER	1023.36	AFA	37670.31	IRR	255.84	6/6/1960
18911CER	1176.00	AFA	38846.31	IRR	294	6/8/1960
18927CER	1280.00	AFA	40126.31	IRR	320	6/14/1960
18928CER		AFA	40126.31	IRR		6/14/1960
18975CER	727.28	AFA	40853.59	IRR	181.82	7/1/1960
34950CER	502.72	AFA	41356.31	IRR	125.68	7/1/1960

GROUND WATER RIGHTS BY PRIORITY

App_Status	Duty_balance_Units	Cumulative total				Priority_date
		duties	Use	Acres	Cumulative Acres	
39552CER	552.12 AFA	41908.43 IRR		138.03	9816.59	7/6/1960
39553CER	543.24 AFA	42451.67 IRR		135.81	9952.40	7/6/1960
18981CER	80.76 AFA	42532.43 IRR		20.19	9972.59	7/6/1960
18988CER	640.00 AFA	43172.43 IRR		160	10132.59	7/8/1960
18989CER	640.00 AFA	43812.43 IRR		160	10292.59	7/8/1960
72936PER	15.00 AFA	43827.43 QM			10292.59	7/8/1960
66207PER	10.00 AFA	43837.43 QM			10292.59	7/8/1960
66208PER	215.01 AFA	44052.45 QM			10292.59	7/8/1960
18999CER	91.20 AFA	44143.65 IRR		22.8	10315.39	7/11/1960
21426CER	640.00 AFA	44783.65 IRR		160	10475.39	7/11/1960
21839CER	632.00 AFA	45415.65 IRR		158	10633.39	7/11/1960
21841CER	632.00 AFA	46047.65 IRR		158	10791.39	7/11/1960
21843CER	624.00 AFA	46671.65 IRR		156	10947.39	7/11/1960
21844CER	632.00 AFA	47303.65 IRR		158	11105.39	7/11/1960
42021CER	548.80 AFA	47852.45 IRR		137.2	11242.59	7/11/1960
19014CER	640.00 AFA	48492.45 IRR		160	11402.59	7/13/1960
19015CER	189.36 AFA	48681.81 IRD		47.34	11449.93	7/13/1960
77145PER	442.64 AFA	49124.45 IRR		110.66	11560.59	7/13/1960
19052CER	AFA	49124.45 IRD			11560.59	7/21/1960
19053CER	AFA	49124.45 IRR			11560.59	7/21/1960
19110CER	640.00 AFA	49764.45 IRD		160	11720.59	8/10/1960
19111CER	622.00 AFA	50386.45 IRD		155.5	11876.09	8/10/1960
43268CER	782.10 AFA	51168.55 IRR		195.52	12071.61	8/12/1960
21427CER	632.00 AFA	51800.55 IRR		158	12229.61	8/22/1960
21428CER	624.00 AFA	52424.55 IRR		156	12385.61	8/22/1960
19145CER	640.00 AFA	53064.55 IRD		160	12545.61	8/24/1960
24606CER	1232.00 AFA	54296.55 IRD		308	12853.61	9/7/1960
19191CER	524.30 AFA	54820.85 IRD		131.08	12984.69	9/9/1960
19192CER	596.60 AFA	55417.45 IRR		149.15	13133.84	9/9/1960
19218CER	735.68 AFA	56153.13 IRR		183.92	13317.76	9/23/1960
24607CER	1232.00 AFA	57385.13 IRD		308	13625.76	9/29/1960
21929CER	630.40 AFA	58015.53 IRR		157.6	13783.36	10/6/1960



GROUND WATER RIGHTS BY PRIORITY

App_Status	Duty_balance_Units	Cumulative total				Priority_date
		duties	Use	Acres	Cumulative Acres	
21930CER	635.20AFA	58650.73IRR		158.8	13942.16	10/6/1960
22315CER	584.40AFA	59235.13IRR		146.1	14088.26	10/6/1960
22316CER	628.80AFA	59863.93IRR		157.5	14245.76	10/6/1960
21399CER	1013.16AFS	60877.09IRR		253.29	14499.05	10/10/1960
19279CER	332.00AFA	61209.09IRR		83	14582.05	10/17/1960
64633CER	AFA	61209.09IRR			14582.05	10/17/1960
48226CER	300.00AFS	61509.09IRR		75	14657.05	10/17/1960
44621CER	AFA	61509.09IRR			14657.05	10/17/1960
23739CER	902.76AFA	62411.85IRR		225.69	14882.74	10/24/1960
19292CER	559.20AFA	62971.05IRR		139.8	15022.54	10/24/1960
19293CER	529.60AFA	63500.65IRR		132.4	15154.94	10/24/1960
35418CER	4.00AFA	63504.65IRR		1	15155.94	11/2/1960
47521CER	168.24AFS	63672.89IRR		42.06	15198.00	11/2/1960
54409CER	4.00AFA	63676.89QM			15198.00	11/2/1960
55660PER	16.00AFA	63692.89QM			15198.00	11/2/1960
73573PER	240.00AFA	63932.89IRR		305.92	15503.92	11/2/1960
19324CER	632.00AFA	64564.89IRD		158	15661.92	11/9/1960
22937CER	632.00AFA	65196.89IRR		158	15819.92	11/9/1960
19360CER	620.00AFS	65816.89IRD		155	15974.92	11/25/1960
19361CER	620.00AFA	66436.89IRD		155	16129.92	11/25/1960
19371CER	362.40AFA	66799.29IRR		90.6	16220.52	12/5/1960
64315PER	52.00AFA	66851.29IRR		13	16233.52	12/5/1960
19378CER	979.20AFA	67830.49IRR		244.8	16478.32	12/9/1960
19379CER	632.00AFA	68462.49IRD		158	16636.32	12/9/1960
19381CER	960.00AFA	69422.49IRR		240	16876.32	12/9/1960
24605CER	276.80AFA	69699.29IRR		40	16916.32	12/9/1960
19411CER	384.00AFA	70083.29IRR		96	17012.32	12/19/1960
72918PER	226.00AFA	70309.29MM			17012.32	12/19/1960
73204PER	16.00AFA	70325.29MM			17012.32	12/19/1960
19490CER	692.28AFA	71017.57IRD		173.07	17185.39	1/25/1961
19492CER	1256.00AFA	72273.57IRD		314	17499.39	1/27/1961
19500CER	664.40AFA	72937.97IRR		166.1	17665.49	1/27/1961



GROUND WATER RIGHTS BY PRIORITY

App_Status	Duty_balance	Units	Cumulative total		Priority_date
			duties	Use	
19501 CER		657.92 AFA	73595.89 IRD	164.48	17829.97 1/27/1961
19502 CER		609.08 AFA	74204.97 IRR	152.27	17982.24 1/27/1961
22217 CER		654.28 AFA	74859.25 IRR	163.57	18145.81 1/27/1961
19526 CER		1204.00 AFA	76063.25 IRR	301	18446.81 2/3/1961
19541 CER		565.20 AFS	76628.45 IRR	141.3	18588.11 2/8/1961
19542 CER		468.00 AFA	77096.45 IRR	117	18705.11 2/8/1961
19563 CER		1279.48 AFA	78375.93 IRR	319.87	19024.98 2/13/1961
19760 CER		1276.00 AFA	79651.93 IRR	319	19343.98 4/18/1961
24272 CER		640.00 AFA	80291.93 IRR	160	19503.98 4/18/1961
46505 CER		510.40 AFA	80802.33 IRR	127.6	19631.58 4/18/1961
19904 CER		16.00 AFA	80818.33 IRR	4	19635.58 6/6/1961
19965 CER		632.00 AFA	81450.33 IRD	158	19793.58 7/3/1961
19966 CER		624.00 AFA	82074.33 IRR	156	19949.58 7/3/1961
19971 CER		AFA	82074.33 IRD		19949.58 7/3/1961
19972 CER		756.20 AFA	82830.53 IRR	189.05	20138.63 7/3/1961
19973 CER		525.12 AFA	83355.65 IRR	131.28	20269.91 7/3/1961
46348 CER		AFA	83355.65 IRR		20269.91 7/3/1961
34948 CER		AFA	83355.65 IRR		20269.91 7/3/1961
28160 CER		AFA	83355.65 IRR		20269.91 7/3/1961
20000 CER		AFA	83355.65 IRD		20269.91 7/24/1961
20001 CER		128.00 AFA	83483.65 IRR	32	20301.91 7/24/1961
20015 CER		AFA	83483.65 IRD		20301.91 7/28/1961
20046 CER		640.00 AFA	84123.65 IRR	160	20461.91 8/23/1961
20087 CER		8.00 AFA	84131.65 IRD	2	20463.91 9/19/1961
20088 CER		16.00 AFA	84147.65 IRD	4	20467.91 9/19/1961
24262 CER		15.08 AFA	84162.73 IRR	3.77	20471.68 9/19/1961
24263 CER		AFA	84162.73 IRR		20471.68 9/19/1961
57835 PER		AFA	84162.73 IRR		20471.68 9/19/1961
57836 PER		AFA	84162.73 IRR		20471.68 9/19/1961
20366 CER		638.31 AFS	84801.04 IRR	159.58	20631.26 3/14/1962
20376 CER		136.80 AFA	84937.84 IRR	34.2	20665.46 3/21/1962
21561 CER		AFA	84937.84 IRR		20665.46 3/21/1962



GROUND WATER RIGHTS BY PRIORITY

App_Status	Duty_balance	Units	Cumulative total				Priority_date
			duties	Use	Acres	Cumulative Acres	
63247 PER		46.00 AFA		84983.84 QM		20665.46	3/21/1962
62929 PER		639.99 AFA		85623.82 MUN		20665.46	5/23/1962
57856 PER		200.00 AFA		85823.82 MUN		20665.46	5/23/1962
57857 PER		180.00 AFA		86003.82 MUN		20665.46	5/23/1962
20478 CER		AFA		86003.82 IRR		20665.46	5/23/1962
20479 CER		AFA		86003.82 IRR		20665.46	5/23/1962
76526 PER		20.00 AFA		86023.82 MUN		20665.46	5/23/1962
20487 CER		510.80 AFA		86534.62 IRR	127.7	20793.16	5/25/1962
50962 CER		129.20 AFA		86663.82 IRR	32.3	20825.46	5/25/1962
20495 CER		33.60 AFS		86697.43 DOM		20825.46	5/31/1962
20565 CER		292.00 AFA		86989.43 IRR	73	20898.46	7/12/1962
20694 CER		AFA		86989.43 IRR		20898.46	9/6/1962
48872 CER		327.10 AFA		87316.53 IRR	81.775	20980.23	12/10/1962
67172 PER		495.07 AFA		87811.60 IRR	123.77	21104.00	12/10/1962
67173 PER		327.80 AFA		88139.40 IRR	81.95	21185.95	12/10/1962
21085 CER		625.60 AFA		88765.00 IRD	156.4	21342.35	2/18/1963
43270 CER		217.90 AFA		88982.90 IRR	54.475	21396.83	8/7/1963
25757 CER		402.00 AFA		89384.90 IRR	100.5	21497.33	8/16/1963
23738 CER		AFA		89384.90 IRR		21497.33	10/30/1963
44452 CER		637.02 AFS		90021.92 IRR	159.26	21656.58	3/4/1964
40010 CER		458.64 AFA		90480.56 IRR	114.65	21771.23	8/6/1964
40011 CER		108.59 AFA		90589.15 IRR	27.4	21798.63	8/6/1964
68448 PER		87.28 AFA		90676.43 IRR	21.82	21820.45	8/6/1964
68449 PER		249.52 AFA		90925.95 IRR	62.38	21882.83	8/6/1964
49731 CER		8.96 AFA		90934.91 STK		21882.83	8/19/1964
49732 CER		8.96 AFA		90943.87 STK		21882.83	8/19/1964
68923 PER		242.00 AFA		91185.87 IRR	60.5	21943.33	10/19/1964
71234 PER		55.20 AFA		91241.07 MM		21943.33	10/19/1964
72917 PER		42.00 AFA		91283.07 MM		21943.33	10/19/1964
74679 PER		144.80 AFA		91427.87 MM		21943.33	10/19/1964
22449 CER		282.80 AFA		91710.67 IRR	70.7	22014.03	2/22/1965
50581 CER		249.66 AFS		91960.33 IRR	62.415	22076.45	12/13/1965
77083 PER		204.74 AFA		92165.07 IRR	51.185	22127.63	12/13/1965



GROUND WATER RIGHTS BY PRIORITY

23462 CER	AFA	92165.07 IRR		22127.63	10/28/1966
23479 CER	89.61 AFA	92254.68 STK		22127.63	11/7/1966
23480 CER	26.79 AFA	92281.47 STK		22127.63	11/7/1966
23481 CER	40.54 AFA	92322.01 STK		22127.63	11/7/1966
23711 CER	AFA	92322.01 IRR		22127.63	2/23/1967
23807 CER	547.88 AFA	92869.89 IRR	165	22292.63	4/17/1967
50650 CER	640.00 AFA	93509.89 IRR	160	22452.63	4/17/1967
29765 CER	656.20 AFA	94166.09 IRR	164.05	22616.68	5/15/1967
23893 CER	AFA	94166.09 IRR		22616.68	5/25/1967
23918 CER	271.20 AFA	94437.29 IRR	67.8	22684.48	6/5/1967
49924 CER	5.86 AFA	94443.15 QM		22684.48	6/5/1967
77315 PER	24.55 AFA	94467.70 QM		22684.48	6/5/1967
71843 PER	9.85 AFA	94477.55 QM		22684.48	6/5/1967
64117 PER	5.16 AFA	94482.71 QM		22684.48	6/5/1967
47520 CER	638.72 AFIS	95121.43 IRR	159.68	22844.16	7/13/1967
24012 CER	5.59 AFA	95127.01 STK		22844.16	7/19/1967
24202 CER	27.50 AFA	95154.51 STK		22844.16	11/6/1967
24203 CER	36.92 AFA	95191.43 STK		22844.16	11/6/1967
24204 CER	44.19 AFA	95235.62 STK		22844.16	11/6/1967
24205 CER	43.42 AFA	95279.04 STK		22844.16	11/6/1967
71963 PER	45.18 AFA	95324.22 STK		22844.16	11/6/1967
67902 PER	6.72 AFA	95330.94 QM		22844.16	11/13/1967
24214 CER	593.59 AFIS	95924.53 IRR	148.4	22992.56	11/13/1967
28061 CER	AFA	95924.53 IRR		22992.56	12/11/1967
63052 PER	44.73 AFA	95969.26 QM		22992.56	2/22/1968
24378 CER	154.00 AFA	96123.26 IRR	38.5	23031.06	2/22/1968
24608 CER	AFA	96123.26 IRR		23031.06	7/25/1968
24610 CER	44.81 AFA	96168.07 STK		23031.06	7/25/1968
24827 CER	AFA	96168.07 IRR		23031.06	12/30/1968
75107 PER	32.80 AFA	96200.87 MM		23031.06	12/30/1968
73629 PER	1.88 AFA	96202.74 STK		23031.06	12/30/1968
73432 PER	162.84 AFA	96365.58 MM		23031.06	12/30/1968
30102 CER	640.00 AFA	97005.58 IRR	160	23191.06	8/27/1969



GROUND WATER RIGHTS BY PRIORITY

App_Status	Duty_balance_Units	Cumulative total				Priority_date
		duties	Use	Acres	Cumulative Acres	
51647 CER	578.80 AFA	97584.38 IRR		144.7	23335.76	9/14/1970
46287 CER	632.00 AFA	98216.38 IRR		158	23493.76	9/14/1970
25820 CER	36.83 AFA	98253.21 MM			23493.76	10/5/1970
47591 CER	508.80 AFA	98762.01 IRR		127.2	23620.96	12/14/1971
26542 CER	101.34 AFA	98863.34 MUN			23620.96	2/9/1972
26543 CER	36.18 AFA	98899.53 MUN			23620.96	2/9/1972
26544 CER	50.67 AFA	98950.19 MUN			23620.96	2/9/1972
26664 CER	160.00 AFA	99110.19 IRR		40	23660.96	4/12/1972
56652 CER	160.00 AFA	99270.19 IRR		40	23700.96	4/12/1972
29278 CER	AFA	99270.19 IRR			23700.96	4/9/1973
28035 CER	201.56 AFA	99471.75 IRR		50.39	23751.35	1/23/1974
28561 CER	520.00 AFA	99991.75 IRR		130	23881.35	8/1/1974
28751 CER	480.00 AFA	100471.75 IRR		120	24001.35	9/26/1974
29121 CER	0.37 AFA	100472.12 MM			24001.35	1/6/1975
43271 CER	525.61 AFA	100997.73 IRR		131.41	24132.76	3/17/1975
43272 CER	525.61 AFA	101523.34 IRR		131.41	24264.17	3/17/1975
43273 CER	514.38 AFA	102037.72 IRR		128.6	24392.77	3/17/1975
43274 CER	514.38 AFA	102552.10 IRR		128.6	24521.36	3/17/1975
43837 CER	111.98 AFA	102664.08 IRR		27.995	24549.36	3/17/1975
43838 CER	111.98 AFA	102776.06 IRR		27.995	24577.35	3/17/1975
43839 CER	109.61 AFA	102885.67 IRR		27.4	24604.75	3/17/1975
43840 CER	109.61 AFA	102995.28 IRR		27.4	24632.15	3/17/1975
43397 CER	640.00 AFA	103635.28 IRR		160	24792.15	7/29/1975
29557 CER	487.36 AFS	104122.64 IRR		121.84	24913.99	7/29/1975
39156 CER	1250.24 AFA	105372.88 IRR		312.56	25226.55	8/8/1975
55535 CER	AFA	105372.88 IRR			25226.55	8/8/1975
29603 CER	64.51 AFA	105437.39 MUN			25226.55	8/25/1975
29873 CER	640.00 AFA	106077.39 IRR		160	25386.55	12/24/1975
29895 CER	502.64 AFA	106580.03 IRR		125.66	25512.21	1/7/1976
30928 CER	433.52 AFA	107013.55 IRR		108.38	25620.59	1/7/1976
44604 CER	91.68 AFA	107105.23 IRR		22.92	25643.51	1/7/1976
44605 CER	79.36 AFA	107184.59 IRR		19.82	25663.33	1/7/1976



GROUND WATER RIGHTS BY PRIORITY

App_Status	Duty_balance	Units	Cumulative total		Cumulative		Priority_date
			duties	Use	Acres	Acres	
49185 CER		502.72 AFA	107687.31 IRR		125.68	25789.01	6/1/1976
65769 PER		34.31 AFA	107721.62 QM			25789.01	6/1/1976
65770 PER		28.23 AFA	107749.85 QM			25789.01	6/1/1976
40402 CER		508.80 AFA	108258.65 IRR		127.2	25916.21	6/10/1976
30913 CER		477.80 AFA	108736.45 IRR		119.45	26035.66	12/10/1976
65768 PER		32.44 AFA	108768.89 QM			26035.66	12/10/1976
77082 PER		697.34 AFA	109466.23 IRR		174.34	26210.00	12/22/1976
50582 CER		850.74 AFA	110316.97 IRR		212.69	26422.68	12/22/1976
31062 CER		553.68 AFS	110870.65 IRR		138.42	26561.10	2/2/1977
31063 CER		523.20 AFA	111393.85 IRR		130.8	26691.90	2/2/1977
31107 CER		628.00 AFA	112021.85 IRR		157	26848.90	2/17/1977
31108 CER		541.44 AFA	112563.29 IRR		135.36	26984.26	2/17/1977
31110 CER		541.44 AFA	113104.73 IRR		135.36	27119.62	2/17/1977
31111 CER		158.00 AFA	113262.73 IRR		39.5	27159.12	2/17/1977
31113 CER		533.60 AFA	113796.33 IRR		133.4	27292.52	2/17/1977
31114 CER		537.60 AFA	114333.93 IRR		134.4	27426.92	2/17/1977
76358 PER		545.44 AFA	114879.37 IRR		136.36	27563.28	2/17/1977
77570 TPER		533.60 AFA	115412.97 IRR		133.4	27696.68	2/17/1977
31249 CER		17.92 AFA	115430.90 STK			27696.68	3/28/1977
31389 CER		17.92 AFA	115448.82 STK			27696.68	4/27/1977
31454 CER		520.00 AFA	115968.82 IRR		130	27826.68	5/3/1977
31455 CER		563.20 AFA	116532.02 IRR		140.8	27967.48	5/3/1977
31563 CER		2.24 AFA	116534.26 QM			27967.48	5/9/1977
32890 CER		174.04 AFA	116708.30 IRR		43.51	28010.99	7/21/1977
43836 CER		AFA	116708.30 IRR			28010.99	7/21/1977
43269 CER		76.80 AFA	116785.10 IRR		19.2	28030.19	7/21/1977
42367 CER		40.00 AFA	116825.10 IRR		10	28040.19	8/3/1977
42368 CER		40.00 AFA	116865.10 IRR		10	28050.19	8/3/1977
42369 CER		120.00 AFA	116985.10 IRR		30	28080.19	8/3/1977
42370 CER		120.00 AFA	117105.10 IRR		30	28110.19	8/3/1977
33018 CER		480.00 AFA	117585.10 IRR		120	28230.19	8/3/1977
33019 CER		480.00 AFA	118065.10 IRR		120	28350.19	8/3/1977



GROUND WATER RIGHTS BY PRIORITY

App_Status	Duty_balance	Units	Cumulative total				Priority_date
			duties	Use	Acres	Cumulative Acres	
33668 CER		1223.74 AFA	119288.84 IRR		305.94	28656.13	9/19/1977
33669 CER		AFA	119288.84 IRR			28656.13	9/19/1977
33670 CER		1264.70 AFA	120553.54 IRR		316.18	28972.30	9/19/1977
33671 CER		AFA	120553.54 IRR			28972.30	9/19/1977
33817 CER		511.60 AFA	121065.14 IRR		127.9	29100.20	9/27/1977
33818 CER		510.80 AFA	121575.94 IRR		127.7	29227.90	9/27/1977
73570 PER		33.20 AFA	121609.14 IRR			29227.90	9/27/1977
73571 PER		128.40 AFA	121737.54 IRR			29227.90	9/27/1977
34561 CER		516.01 AFA	122253.55 IRR		129	29356.90	11/3/1977
34562 CER		499.48 AFA	122753.03 IRR		124.87	29481.77	11/3/1977
34596 CER		501.82 AFA	123254.85 IRR		125.45	29607.23	11/10/1977
48225 CER		146.30 AFS	123401.15 IRR		36.575	29643.80	11/10/1977
73899 PER		631.18 AFA	124032.32 IRR		157.79	29801.60	11/21/1977
44610 CER		80.04 AFA	124112.36 IRR		20.01	29821.61	2/3/1978
34939 CER		520.00 AFA	124632.36 IRR		120	29941.61	2/3/1978
35009 CER		640.00 AFA	125272.36 IRR		160	30101.61	2/16/1978
35012 CER		511.60 AFA	125783.96 IRR		127.9	30229.51	2/16/1978
35013 CER		546.64 AFA	126330.60 IRR		136.66	30366.17	2/16/1978
42020 CER		88.00 AFS	126418.60 IRR		22	30388.17	2/16/1978
39554 CER		AFA	126418.60 IRR			30388.17	2/16/1978
73572 PER		128.40 AFA	126547.00 IRR			30388.17	2/16/1978
65877 CER		4.48 AFA	126551.48 STK			30388.17	3/17/1978
46461 CER		576.00 AFA	127127.48 IRR		144	30532.17	3/17/1978
49188 CER		502.72 AFA	127630.20 IRR		125.68	30657.85	3/17/1978
50095 CER		508.80 AFA	128139.00 IRR		127.2	30785.05	3/17/1978
49853 CER		118.52 AFA	128257.52 IRR		29.63	30814.68	5/2/1978
49854 CER		AFA	128257.52 IRR			30814.68	5/2/1978
35374 CER		108.44 AFA	128365.96 IRR		27.11	30841.79	5/2/1978
35375 CER		387.04 AFA	128753.00 IRR		96.76	30938.55	5/2/1978
47518 CER		336.00 AFA	129089.00 IRR		84	31022.55	5/12/1978
35708 CER		398.40 AFA	129487.40 IRR		99.6	31122.15	8/7/1978
64317 PER		88.00 AFA	129575.40 IRR		22	31144.15	8/7/1978



GROUND WATER RIGHTS BY PRIORITY

App_Status	Duty_balance Units	Cumulative total duties	Use	Acres	Cumulative Acres	Priority_date
47519 CER	127.20 AFS	129702.60 IRR		31.8	31175.95	9/13/1978
41883 CER	156.80 AFS	129859.40 IRR		39.2	31215.15	9/20/1978
41884 CER	AFS	129859.40 IRR			31215.15	9/20/1978
40013 CER	44.00 AFA	129903.40 IRR		11	31226.15	10/20/1978
40014 CER	393.04 AFA	130296.44 IRR		98.26	31324.41	10/20/1978
36070 CER	AFA	130296.44 IRR			31324.41	10/20/1978
65200 PER	430.72 AFA	130727.16 IRR		107.68	31432.09	10/20/1978
65201 PER	374.00 AFA	131101.16 IRR		93.5	31525.59	10/20/1978
68446 PER	136.00 AFA	131237.16 IRR		34	31559.59	10/20/1978
68447 PER	44.00 AFA	131281.16 IRR		11	31570.59	10/20/1978
48437 CER	AFS	131281.16 IRR			31570.59	12/29/1978
44607 CER	80.04 AFA	131361.20 IRR		20.01	31590.60	12/29/1978
37933 CER	5.74 AFA	131366.94 STK			31590.60	4/17/1979
44743 CER	2.88 AFA	131369.83 STK			31590.60	10/29/1981
44783 CER	1.44 AFA	131371.27 STK			31590.60	10/29/1981
44784 CER	1.10 AFA	131372.38 STK			31590.60	10/29/1981
45534 CER	8.26 AFA	131380.63 MUN			31590.60	4/14/1982
47304 CER	2.79 AFA	131383.42 COM			31590.60	10/5/1983
47907 CER	5.06 AFA	131388.49 STK			31590.60	3/15/1984
62928 PER	361.98 AFA	131750.46 MUN			31590.60	3/1/1991
57777 CER	11.20 AFA	131761.67 STK			31590.60	6/23/1992
63497 CER	408.30 AFA	132169.97 IRR		120.71	31711.31	10/10/1997
65481 CER	11.20 AFA	132181.17 STK				9/7/1999
65483 CER	11.20 AFA	132192.37 STK				9/9/1999
66439 CER	6.72 AFA	132199.09 STK				6/8/2000
66440 CER	19.24 AFA	132218.33 STK				6/8/2000
66441 CER	19.24 AFA	132237.57 STK				6/8/2000
67144 CER	9.05 AFA	132246.62 STK				1/17/2001
68122 CER	8.96 AFA	132255.58 STK				10/19/2001
70073 PER	13.57 AFA	132269.15 STK				6/2/2003
70305 PER	4.48 AFA	132273.63 STK				8/6/2003
67450 CER	5.66 AFA	132279.29 STK				1/12/2004
73118 PER	5.79 AFA	132285.08 STK				8/3/2005



State Engineer Options

- Regulate by Priority.
- Forfeit water rights.
- Change irrigation rights for consumptive use only.
- Cancel water rights for failure to show due diligence.
- Deny all extension of time requests & call for PBU's.
- Impose fines and penalties for over pumping,
pumping outside the permitted place of use or any
other violation of the water law, permits, certificates,
statutes or regulations.



Extensions of Time and Possible Forfeitures

- POC's with extensions 1,378.44 AF
- PBU's with extensions 6,600.57 AF
- Subject to Forfeiture 8,145.24 AF
Total 16,124.25 AF



Other Options

- Withdraw water rights covering pivot corners.

Doesn't prevent the lowering of the water table now but prevents future transfers from making the problem worse.
- Spread out pumping.
- Become more efficient.
- Grow crops that have a lower water consumption.



Other Options

- Interbasin transfer of water to replace or recharge existing water sources
- Cloud seeding
- New Technology
 - Rotary Subsoiler
(to increase water infiltration)



Other Options

- Form a local groundwater management task force to:
 - Set goals to systematically reduce pumping
 - Certain % reductions over a given number of years
 - Explore ideas for retiring water rights
- Necessity is the mother of invention!!!



Open Discussion

